BE24 OEM's Manual

-V1.26X

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Bernini Design SRL (hereinafter "BD") warrants that Be24 shall be free from defect in material or workmanship for a period of 3 years from the BD delivery date. BD shall at its option repair or replace the product without charge. BD shall return the Be24 to the buyer with the Default parameters with no charge. The buyer shall furnish sufficient information on any alleged defects in the product so as to enable BD to determine their cause and existence. If the Be24 is not defective, or the product is defective for reason other than covered by this warranty, the buyer will be charged accordingly. This warranty shall not apply if the Be24 has not been used in accordance with the User Manual and other operating instruction, particularly if any defects are caused by misuse, improper repair attempts, negligence in use or handling..
This purchase is non-refundable.

This equipment complies with the EMC requirements CE

WARNING!! **High voltage is present inside the Be24. To avoid electric-shock hazard, operating personnel must not remove the protective cover. Do not disconnect the grounding connection. The Be24 can start the engine at anytime. Do not work on equipment, wich is controlled by the BE24. When servicing engine disconnect the battery and disconnect the battery charger. It is recommended that warning signs be placed on equipment indicating the above.**

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1.0 INTRODUCTION

The BE24 features Engine and Generating Set (hereinafter GEN-SET) control and monitoring. The BE24 provides visual indication by means of LEDs and a Display. It features OFF, MAN and AUTO operating modes. The display gives Messages for the following failures: Low Fuel Level, Emergency Alarm, Low Oil Pressure, High Temperature, High/Low Battery Voltage, Belt Break/Charger Failure, Over/Under Frequency, Fail to start, Alternator Failure, Over/Under Voltage, Over/Under Speed and Overload.

By using the [UP-DOWN] pushbutton, the following measurements are displayed: Generator Voltage/Current/Frequency, Battery Voltage, Hours Meter, Charger Alternator Voltage and R.P.M..

The BE24 provides static outputs for START, STOP, ALARM (or GENERATOR CONTACTOR), FUEL SOLENOID and PRE-GLOW.

The BE24 features 28 programmable parameters, measurements and calibrations. The front panel includes 6 pushbuttons, 2 LEDs and a 4-digit DISPLAY.

2.0 OPERATING MODE selection

The Be24 features AUTO (section 2.1), MANUAL (section 2.2) and OFF (section 2.3) operating modes.
When the power supply is switched on, the BE24 behaves as follow:

A) if the KEY-SWITCH is in the ***OFF position,*** the BE24 enters the OFF operating mode.
B) if the KEY-SWITCH is in the ***ON position,*** the Be24 enters the AUTO operating mode. That is, if the Be24 was in AUTO prior to the supply removal. If not, the Be24 enters the MANUAL operating mode.

2.1 AUTO operating mode

The BE24 operates according to the parameters indicated in the section 11.0.
The parameters [P.2]---[P.5] control the starting cycle. The Be24 initiates the starting of the engine if the 'REMOTE START' input energizes (terminal #7, see section 9.0) or the parameters [P.26]-[P.27] have been programmed. (A.P.T., see section 11.0 and 19.0).
To enter the 'AUTO' operating mode use the following instructions:
A) - Turn ON the KEY-SWITCH (***NOTE1***); the BE24 tests the Lamps (the Display and LEDs illuminate for 1 second)
B) - Wait for the end of the LAMP test, then push the AUTO pushbutton after the [UUUU] (Pre-glow cycle) or [Sta-] (Start prompt) has been displayed. After this, the yellow Led AUTO will illuminate. If the REMOTE START input is not operative (according to the N.C./N.O programming), the LED will flash. If operative, the LED illuminates continuously and a start cycle will take place.
C) - In order to cancel the AUTO operating mode, push the AUTO pushbutton (the yellow Led will turn OFF) or turn the KEY-SWITCH to OFF.

NOTE1 In case the programming terminal (P.E.) remains connected, the BE24 will display the blinking message [JUMP]. The BE24 cancels the message when the PROGRAM connection is opened (see section 6.0).

Once in AUTO, the Be24 waits for a REMOTE START activation (see section 9.0).
In case of an Automatic Periodic Test (A.P.T.), the display will show the message [tESt] (see application note in section 19.0).
The Be24 stores the AUTO operating mode in the memory. If the battery supply fails and restores, the Be24 will enter the AUTO operating mode. To clear the memory of the AUTO operating mode, push the AUTO pushbutton, or turn OFF the KEY-SWITCH.

2.2 MANUAL operating mode

MANUAL operating mode allows you to manually start the Engine by means of the KEY SWITCH. To start the engine follow the instructions:
A)- Turn ON the KEY-SWITCH; the BE24 illuminates the LEDs and Display.
B)- If the display shows the message [uuuu], the BE24 is counting the PRE-GLOW time ([P.13]/[P.14]); wait until the message disappears.
C)- After the display shows the flashing message [StA-] (***NOTE2***), turn the Key to START position (momentary position with spring-loaded return) until the engine starts. The message [. . . .] indicates a MANUAL start.
D)-To stop the engine, turn the KEY SWITCH to OFF operating mode.

NOTE2: Be24 shows the blinking [StA-] message for 20 seconds. After this time, if the engine does not start, the Be24 shuts down the FUEL SOLENOID and displays the message [FAIL] (Fail to start, see section 4.07).To clear the alarm, turn the KEY-SWITCH to OFF.

2.3 OFF operating mode

The OFF operating mode clears the fault alarms and shuts down the Display after 5 seconds. This function is obtained by turning the KEY SWITCH to OFF. In OFF operating mode, the BE24 allows programming of the parameters (see section 6.0 and 10.0).

3.0 DISPLAY features

The BE24 features a 4 Digit Display (section14.0) to show measurements, settings and error messages. The [UP-DOWN] pushbutton selects one of the following menus: **[UXXX](*)** (VOLTAGE) **[AXXX]** (CURRENT) - **[rPM] [XXXX]** (SPEED, RPM) - **[HXXX]** (FREQUENCY)- **[bXX.X]** (BATTERY-V) - **[cXX.X]** (Charger Alternator voltage) or **[h] [XXXX]** (Hour count). Each menu is indicated by means of a symbol on the left side of the display. If the Be24 stays in OFF operating mode for more than 5 seconds, the display shuts down. A blinking dot indicates the presence of the power supply. Press one of the pushbuttons to energize the display.
The list of the display menus follows:

[AXXX] The BE24 indicates the Generator Current measurement (00.0 up 99.9Aac and 100 up to 999 Aac). The parameter [P.10] sets the Current Transformer size and the parameter [P.11] sets the Overload threshold (section 11.0). The message [A.---] indicates overflow.

[UXXX] The Voltage of the GEN-SET is displayed from 80Vac up to 600Vac. The settings for Under/Over Voltage are the parameters [P.6] and [P.7].

[rPM][XXXX] The message **[rPM]** appears momentarily and the Speed of the engine (RPM) is displayed according to the parameter [P.23]. If [P.23] is set to [Inh.] (inhibit), the display indicates [----] in order to inhibit the reading. The parameters [P.21]/[P.22] allow Under/Over Speed settings (see section 17.10).

[HXX.X] The display shows the Frequency of the Generator (10,0-99,9Hz). The parameters [P.8] and [P.9] set the Under/Over Frequency.

[bXX.X] The BE 24 indicates the Battery Voltage (see section 4.14 for alarm settings).

[cXX.X] The BE 24 indicates the Charger Alternator Voltage (see section 12.)

[h] [XXXX] The Display shows the HOUR METER. The BE24 allows a maximum count of 9999h. The message **[h]** appears for a moment (see section 10.0), and then, the counter will be displayed continuously.

(*)NOTE 3: the symbol 'X' means a numerical field.

4.0 ALARM messages

The alarms are displayed by means of messages. To remove the message, turn OFF the KEY-SWITCH. Remove always the alarm before to start the engine.
The BE24 may show one of the following:

4.01 **[OIL]** (LOW OIL PRESSURE): indicates the Low Oil Pressure shutdown. The input is connected to an external normally closed contact (input #3). The Oil Pressure Switch is by-passed by means of the [P.25] timing (section 11.0).

4.02 **[°C]** (HIGH ENGINE TEMPERATURE): indicates the High Temperature shutdown. This input (terminal #4) is connected to a normally open or closed temperature switch. The polarity of the contact is selected by means of a code in the [P.18] (option [n.o.] or [n.c.]). The alarm is bypassed for 1 second.

4.03 **[O.SPd.]** (OverSPEED) The alarm is detected from the Pick-UP (or 'W' terminal of the Charger Alternator, see section 17.10). The parameters [P.22]-[P.23] allow full monitoring of the speed. The message blinks to indicate Over Speed (1 second by-pass). To display the Speed value that shut down the engine, push the [F1] pushbutton.

4.03A **[U.SPd]** (UnderSPEED) The alarm is detected from the Pick-UP (or 'W' of the Charger Alternator see section 17.10). The parameters [P.21]-[P.23] allow full monitoring of the speed. The message blinks to indicate Under Speed shut down (6-second timing by-pass). To display the Speed value that caused the failure push the [F1] pushbutton.

4.04 **[bELt]** (BELT BREAK). The alarm is enabled by programming the [on] code into [P.15].

There is a 'Belt Break' alarm when the Generator voltage is within the settings, but the output voltage of the Charger Alternator is lower than the threshold of [P.3]. A 20-second delay prevents false alarms. The [OFF] code, programmed into [P.15], inhibits the alarm.

4.05 **[ALAr]** (EMERGENCY ALARM) This message indicates the External Emergency Stop (input #5). The BE24 stops the engine immediately. The polarity of the EMERGENCY Stop contact is programmed into the [P.19] (option [n.o.] or [n.c.]).

4.06 **[FUEL]** (FUEL ALARM) This message indicates Low Fuel in the tank (input#6). The engine stops if the contacts remain closed for 5 minutes continuously. To clear the alarm, follow the instructions:

a) turn OFF the key switch
b) fill the tank
c) turn ON the key to display the message [FULL]
d) turn OFF the key in order to cancel the alarm
e) turn ON the key to select the MANUAL or AUTO operating mode

4.07 **[FAIL]** (STARTING FAILURE). This alarm activates if the engine does not start after a complete starting cycle, (see settings of the parameters [P.2]-3]-4]-5] in section 11.0) or after a failed MANUAL starting cycle.

4.08 **[E 04]** (GENERATOR FAILURE). This message will be displayed if there is no Voltage or Frequency to the generator for 150 seconds after the engine has been started. The alarm monitoring is disabled if the [P.12] contains the [OFF] code or the BE24 is in MANUAL operating mode.

4.09 **[E 05]** (GEN-SET OVERLOAD). The engine will stop if the current of the Generator rises above the setting ([P.11]) for 6 seconds continuously. To determine the Current that caused the failure, push the [F1] pushbutton.

4.10 **[Hi H]** (OVER FREQUENCY) The Over Frequency setting is programmed into [P.9]. The protection is delayed by about 2 seconds. The Be24 shuts down the engine. To determine the Frequency that caused the failure, push the [F1] pushbutton.

4.11 **[Lo H]** (UNDER FREQUENCY) The Under Frequency setting is programmed into [P.8]. The protection is delayed by about 6 seconds. The Be24 shuts down the engine. To determine the Frequency that caused the failure, push the [F1] pushbutton.

4.12 **[Hi U]** (OVER VOLTAGE) If the voltage rises above the [P.7] setting for more than 2 seconds, the Over-Voltage alarm energizes and the engine shuts down. To determine the Voltage that caused the failure, push the [F1] pushbutton.

4.13 **[Lo U]** (UNDER VOLTAGE or SHORT CIRCUIT) The alarm energizes if:
- the voltage drops under the [P.6] setting for more than 6 seconds
- the voltage drops under the [P.6] setting (by more than 20%) for more than 1 second
To determine the Voltage that caused the failure, push the [F1] pushbutton.

4.14 **[XX.X]** (Battery voltage alarm, Blinking indication)**.** The alarm settings are automatically fixed to 11,8/15.0V for a 12V battery and 23,6/30.0V for a 24V battery. The alarm is delayed about 120 seconds and is ignored during Pre-Glow and starting cycles. The engine does not shut down and the user can select other display menus by using the [UP-DOWN] pushbutton.

4.15 **[Err]** (MEMORY ERROR) This message indicates an internal failure of the memory. It is possible to restore the normal operating mode of the memory by disconnecting the supply and re-applying after a minute. If the failure persists, follow the instructions:

- Enter in CALIBRATION (see section 16.0)
- Clear the MEMORY (see section 16.1)

4.16 **[JUMP]** This message appears in AUTO operating mode if the PROGRAM connection is grounded. The message reminds you to remove the PROGRAM connection.

4.2 OPERATING messages

BE24 features messages to inform you about the following:
[uuuu] (PRE-GLOW). The BE24 is driving the GLOW PLUGS cycle ([P.13])
[U---] (V-METER out of range). The voltage of the Generator has fallen under 80Vac
[StA-] (Prompt). The BE24 expects you to start the engine by turning the KEY-SWITCH to START or by selecting the AUTO operating mode.
[. . . .] This message indicates that the KEY is turned to START position.
[rESt] (START-cycle). The BE24 is counting the rest time ([P.4] setting)
[tESt] (A.P.T). The BE24 tests the engine according to the [P.26]-[P.27] (see section 19.0)
[CAL] (CALIBRATION): see section 16.0.
[Pro-] (PROGRAMMING); see section 6.1
[rEAd] (READING): see section 6.3
[StOP] (STOP): the BE24 is driving the stop cycle ([P.16] setting)
[MM.SS] (MM=Minutes and SS=seconds): the BE24 indicates the count down of the parameters [P.0] (Remote Start Delay) or [P.1] (Remote Stop Delay).

NOTE: the BE24 shuts down the display during the crank.

5.0 LEDs for visual indication

The BE24 features two LEDs to indicate the following conditions:

ENGINE RUNNING [Green LED]. This led illuminates when the voltage of the Charger Alternator applied to terminal #1 is higher than the setting programmed into [P.3] (sections 11.0, 12.0). If the Engine does not have a Charger Alternator, the parameter [P.3] has to be set in [INH.] and [P.15] in OFF. In this case, the green LED 'ENGINE RUNNING' energizes only by means of the following:

- the Voltage of the Generator is over 80Vac
- the Frequency of the Generator is over 20Hz
- the speed of the engine is over the CRANK OFF ([P.24]) setting

The above conditions are continuously monitored in order to terminate the crank independently of the programming of the [P.3] parameter, if necessary.

AUTO [Yellow LED]. This is an optical indication of the AUTO operating mode. The yellow LED blinks to indicate a standby mode. The BE24 monitors the REMOTE CONTROL (input #7) and expects a command.
The yellow LED illuminates continuously when the REMOTE CONTROL INPUT is activated (see section 9.0).

5.1 Lamp and Display Test

A test of the LEDs and DISPLAY is obtained automatically anytime the key switch is turned ON. The LEDs and DISPLAY light up for about 1 second.

6.0 PROGRAMMING instructions

The section 11.0 describes the adjustable parameters. The display shows the name (example [P.12]) and the setting of the parameter (example [500]). To enter the program mode, follow the instructions.

6.1 Programming

1)- Turn OFF the KEY SWITCH, making sure that the power supply is over 12.0V.
2)- Remove the cover and connect to ground the 'PROGRAM' terminal (# P.E.)
3)- Turn ON the key switch
4)- Push and hold the [UP/DOWN] pushbutton until the message [Pro.M.] appears
5)- Turn OFF the key switch
6)- Hold the [UP/DOWN] button pressed until the message [Pro.m.] appears. When the [Pro-] message appears, release the [UP/DOWN] pushbutton: the [P.0] message will indicate the first programmable parameter.
7)- Press the [UP-DOWN] pushbutton to select the parameter ([P.0] to [P.28]).
8)- Press [F1] to display the parameter. Push [F1] and [+] (or [-]) simultaneously to modify the setting of the parameter (the display updates the value of the parameter).

To save and quit:

9)- Press [ENTER] until the [SAVE] message appears (approximately 5 seconds)
10)- The message [Good] will confirm the saving procedure (***NOTE 5***)
11)- Open the connection of the PROGRAM terminal (# P.E.) and put the cover in place.

To exit without saving:

9A)- Open the connection of the PROGRAM terminal (# P.E.) and remove the supply.
10A)- We recommend that you verify all parameters (see section 6.3)

NOTE 5: *the message [Err] indicates an error of the saving procedure. We recommend that you repeat step 8. If the [Err] message remains on the display, try to cancel the memory by following the instructions indicated in the section 16.1 ([MEM]).*

6.2 Re-programming Default settings

The parameters of the BE24 are factory programmed with DEFAULT settings (see section 11.0). To use the DEFAULTS, enter the Program Mode (section 6.0) and push the [+] and [-] pushbutton simultaneously until the display shows the message [dEF-] (approximately 5 seconds). The display will continue to flash awaiting a user confirmation:
-to save the DEFAULTS, push the [ENTER] pushbutton until the message [SAVE] appears (the previous settings will be lost).
-to cancel the operation, turn the key directly into the ON position without using the [ENTER] pushbutton.

6.3 Parameter reading

When the BE24 is in OFF operating mode (see section2.3) it is possible to read the parameters. Use the following procedure:
A) - Open the connection of the PROGRAM terminal input (# P.E.)
B) - Push and hold the [F1] pushbutton approximately 10 seconds
C) - Wait until the message [rEAd] appears on the display for a second
D) - The display will show the first programmable parameter ([P.0]).
E) - Push the [F1] pushbutton: the display will indicate the value of the parameter.
F) - Push the [UP-DOWN] pushbutton to select a parameter, and push [F1] to display the setting.
G)- The display returns to menu mode if you have not used the pushbuttons for 30 seconds.

7.0 GLOW PLUGS control (Diesel engine)

Output #11 energizes the Glow Plugs. The default programming disables this output (parameter [P.14]=0). The 'Pre-Glow' is obtained by programming a timing into [P.13], and by setting the code [2] into [P.14] (see section 11.0). The output will energize prior to starting the engine.

8.0 'CHOKE' control (Gasoline engine)

To drive the CHOKE, output #11 is provided. The default programming disables this output (parameter [P.14]=0). If you wish output number 11 to energize at the beginning of each starting attempt, program a time from 2 to 4 seconds into [P13], and program either the code [1] or [3] into [P.14] (see section 11.0). The output will de-energize after a [P.13] programmed number of seconds. To inhibit the CHOKE at high engine temperature, an external temperature switch connected in series with the #11 terminal is recommended. NOTE:
-with option [1], the choke shuts down when the engine is running
-with option [3], the choke shuts down only after the programmed time, independently of the engine running condition.

9.0 REMOTE START

The BE24 features REMOTE START only in AUTO operating mode. Input #7 can be operated normally closed or normally open according to the [P.20] parameter.
To operate the REMOTE START, follow the instructions (assuming that the remote Start operates normally open).

9.1 - To put the Be24 in AUTO use the following instructions:

A) - Turn the KEY-SWITCH to the ON position; the Display and LEDs illuminate for 1 sec.
B) - Wait until the end of the LAMP test.
C) - Push the AUTO pushbutton as soon as possible (otherwise, after 20 seconds the BE24 enters the STARTING FAILURE); the AUTO yellow LED will illuminate as described in the section 9.2

9.2 - REMOTE START SWITCH:

If the REMOTE START input is closed, the yellow AUTO LED illuminates continuously and the display will indicate the count down of the timer [P.0] by means of the message [MM.SS] (Minutes and seconds). The engine will start after the programmed [P.0] delay time.
If the REMOTE START switch opens, the Be24 drives the [P.1] timer (STOP DELAY TIME). The display will indicate the count down by means of the message [MM.SS] (Minutes and seconds), and the AUTO yellow LED will flash. After the [P.1] timing the engine will stop.

10.0 HOUR METER reset

To clear the counter follows the instructions:
- Turn OFF the KEY-SWITCH .
- Press the [UP-DOWN] pushbutton to select the 'h' menu (HOUR METER mode display)
- The message [h] will appear for a moment, and then the HOUR METER (example [9657]) will be displayed continuously.
- Push and hold the [+] and [-] pushbuttons simultaneously, approximately 10 seconds, until the display blinks once.
- Release the pushbuttons; the [0] count will appear on the display.

11.0 PARAMETERS DESCRIPTION *Note: ['] means minute(s) and ["] means second(s)]*

Display	Parameter
[P.0] **[1"]**	**Remote Start Delay Timing** **(Input #7)** Range: 1-59 secs or 1-15 mins Seconds or minutes of continuous REMOTE START command to initiate the automatic engine start. (see section 9.0 and [P20] in this section)
[P.1] **[1"]**	**Remote Stop Delay Timing** **(Input #7)** Range: 1-59 secs or 1-15 mins Seconds or minutes of continuous absence of the REMOTE START command to initiate the stop cycle. (see section 9.0 and [P.20] in this section)
[P.2] **[5"]**	**Crank Timing (Output #10)** Range:1-20 seconds Maximum insertion time of the *Starter Motor*. The timer is cleared if the engine starts to run.
[P.3] **[8.0]**	**Engine Running Trigger** **(Input #1)** Range: 3V-24V,[inh] If the voltage of the Charger Alternator rises above the [setting], the *Starter Motor* is disconnected (see section 12.0). The [inh.] code allows the use of engines without the Charger Alternator
[P.4] **[3"]**	**Rest Timing** Range: 3-20 secs Time interval between starting attempts
[P. 5] **[3]**	**Starting Attempts** Range: 1-10 This parameter sets the number of attempts in the automatic start cycle
[P.6] **[inh.]**	**Generator UnderVoltage, short-circuit** Range: 80-400V (5V Step) If the voltage rises above the [setting], the BE24 enables the protection. If the voltage drops under the [setting] for at least 6 secs, or under [setting]-20% for 1 sec, the Under-Voltage protection [Lo U] will shut down the engine.
[P.7] **[Inh.]**	**Generator Over-Voltage** Range: 110-550V or [inh.](5V Steps) If the Generator voltage rises above the [setting] for at least 2 seconds, the BE24 will energize the over voltage protection [Hi U] (see section 4.0) to stop the engine. The [inh.] code inhibits the over voltage.
[P.8] **[Inh.]**	**Generator Under-Frequency** [inh.] to 99Hz ([inh]=disables the under frequency) This protection is delayed by about 6 seconds. The BE24 shuts down the engine and the display will show the [Lo H] message (see section 4.11).
[P.9] **[Inh.]**	**Generator Over-Frequency** 45 to [inh.] ([inh.] disables the over frequency)

	This protection is delayed by about 2 seconds. The BE24 shuts down the engine and displays [Hi H] (see section 4.10)
[P.10] **[500]**	**Current Transformer Size** The range is 10/5 up to 1000/5 The settings are allowed only in steps of 10.
[P.11] [inh.]	**Generator Overload Setting** Range: [inh.] to 1000 A The BE24 shuts down the engine after a delay of 6 secs and shows the message [E05].The setting is allowed in steps of 1A (CT 10/5 up to 100/5) and 10A (CT100/5 up to 1000/5).
[P.12] **[OFF]**	**Generator Failure Alarm** selection: [on] or [OFF] The code [on] enables the *Generator* failure alarm. The alarm energizes if the voltage (or the frequency) falls below the UnderV/Hz settings for more than 150 seconds. The BE24 shows the [E04] message and the engine will shut down.
[P.13] **[10"]**	**Glow Plugs/Choke Control** **(Output #11)** Range: 1 to 99 secs The BE24 energizes the output #11 for the programmed time. The [P.14] controls the operating mode of the output #11 (Pre-Glow or Choke section 7.0 and 8.0)
[P.14] **[0]**	**Output Control** The following options are available: **[0] None** **[1] Choke Control** (section 8.0) **[2] Glow Plugs Control** **[3] Choke Control** (section 8.0)
[P.15] **[OFF]**	**Belt Break Control** Selection: [on] or [OFF] The Belt Break (or *Charger Alternator* failure) alarm is indicated by means of the message [bELt] (see section 4.0)
[P.16] **[15"]**	**Stop Solenoid Timing** **(output #12)** Range: 2-99 secs Duration of the Stop cycle (output #12). The stop solenoid will remain energized for the programmed time.
[P.17] **[1']**	**Alarm Output Timing** **(Output #2)** [inh.]-59 secs 1-15 mins and [cont] Time-out of the alarm output #2. The code [cont] disables the time-out, and the alarm remains energized until the OFF operating mode is selected. The [inh.] mode enables the use of the external contactor (see parameter [P.28] and section 19.3)

[P.18] **[n.o.]**	**Temperature Switch** **(INPUT #4)** Selection: [n.o.] or [n.c.] **[n.o.]** normally open contact: the engine shuts down if the contact closes **[n.c.]** normally closed contact: the engine shuts down if the contact opens
[P.19] **[n.o.]**	**ALARM Control (INPUT #5)** Selection: [n.o.] or [n.c.] **[n.o.]** normally open contact: the engine shuts down if the contact closes **[n.c.]** normally closed contact: the engine shuts down if the contact opens
[P.20] **[n.o.]**	**Remote Start (INPUT #7)** Selection: [n.o.] or [n.c.] **[n.o.]** normally open contact: the engine starts if the contact closes **[n.c.]** normally closed contact: the engine starts if the contact opens
[P.21] **[Inh.]**	**Under Speed setting** [Inh.] or 100-4000 r.p.m.. The BE24 by-passes the protection by 6 seconds to avoid false alarms. The [Inh.] code (setting <100 r.p.m.) disables the Under Speed shut down.
[P.22] **[Inh.]**	**Over Speed setting** 100-4000 rpm or [Inh.]. The BE24 provides one second bypass delay. The [Inh.] code (>4000 r.p.m.) disables the Over Speed shut down.
[P.23] **[Inh.]**	**Number of Teeth of the Flywheel** [Inh.] or 1-500 teeth. The [Inh.] code (setting <1) disables the reading of the Speed (section 3.0), the Over/Under Speed alarms, and the Crank termination (see [P.24]).
[P.24] **[Inh.]**	**Crank OFF** Crank Termination setting: 100-800 rpm If the speed rises above the setting, the BE24 terminates the crank cycle. One second delay avoids false termination. The allowed range is 100 up to 800 R.P.M. The code [Inh.] inhibits the crank termination (see also [P.23])
[P.25] **[6"]**	**Low Oil Pressure Alarm By-Pass** Range: 0-99 secs By-Pass Delay to ignore the Oil Pressure (input #3) during the engine starting cycle. This input requires normally closed contact
[P.26] **[inh.]**	**Automatic Periodic Test Cycle** Range: [inh.], 1-99 days This is the interval time between the automatic periodic tests of the engine. The code [inh.] disables the Automatic Periodic Test (see section 19.0)
[P.27] **[5']**	**Automatic Engine Test Duration** Range: 1-99 minutes This is the duration of the automatic engine test (see section 19.0).
[P.28] **[5"]**	**Generator warm-up timing** Range [inh.] 1-59 secs or 1-15 mins ([inh.]=No warm-up) Active only when [P17]= [inh.] and the ALARM output is used to drive the GEN-SET contactor
[P.29] **[5"]**	**Generator cooling timing** Range [inh.] 1-59 secs or 1-15 mins ([inh.]=No cooling) Active only when [P17]= [inh.] and the ALARM output is used to drive the GEN-SET contactor

12.0 ENGINE RUNNING setting

The BE24 inhibits the START output when the engine runs without the aid of the starter motor.
When the engine is not running the D+/WL (input #1) voltage is 0V. As soon as the BE24 starts the engine (manual or automatic cycle), a current of a few hundred mA flows into the D+ terminal.
At this moment the engine is not running, but a voltage appears in the D+/WL terminal (0,8 to 2,5V). As soon as the engine starts to run, the voltage of the D+/WL terminal increases by up to 3V-6V. When the engine runs, the voltage reaches the nominal 14V needed to charge the battery. The safest point to disconnect the starter motor is between 6V and 10V.
The default parameter of the [P.3] is [8.0]V. This value is recommended for engines using 12V batteries. For a 24V battery, a setting of 16V is recommended.
The setting is good if the green 'ENGINE RUNNING' LED, on the front panel, remains off during the starting attempts cycle.

NOTE : the Charger Alternator voltage can be displayed in the 'BATTERY' display mode. By pushing the [UP-DOWN] pushbutton, the BE24 removes the Battery voltage indication, and displays the Charger Alternator voltage. The display shows the voltage of the Charger. The accuracy of the display is guaranteed to within 5% using a standard Charger Alternator. For other chargers (FlyWheel Generator) the reading is not accurate. The [P.3] setting, in this case, expresses only a proportional factor.

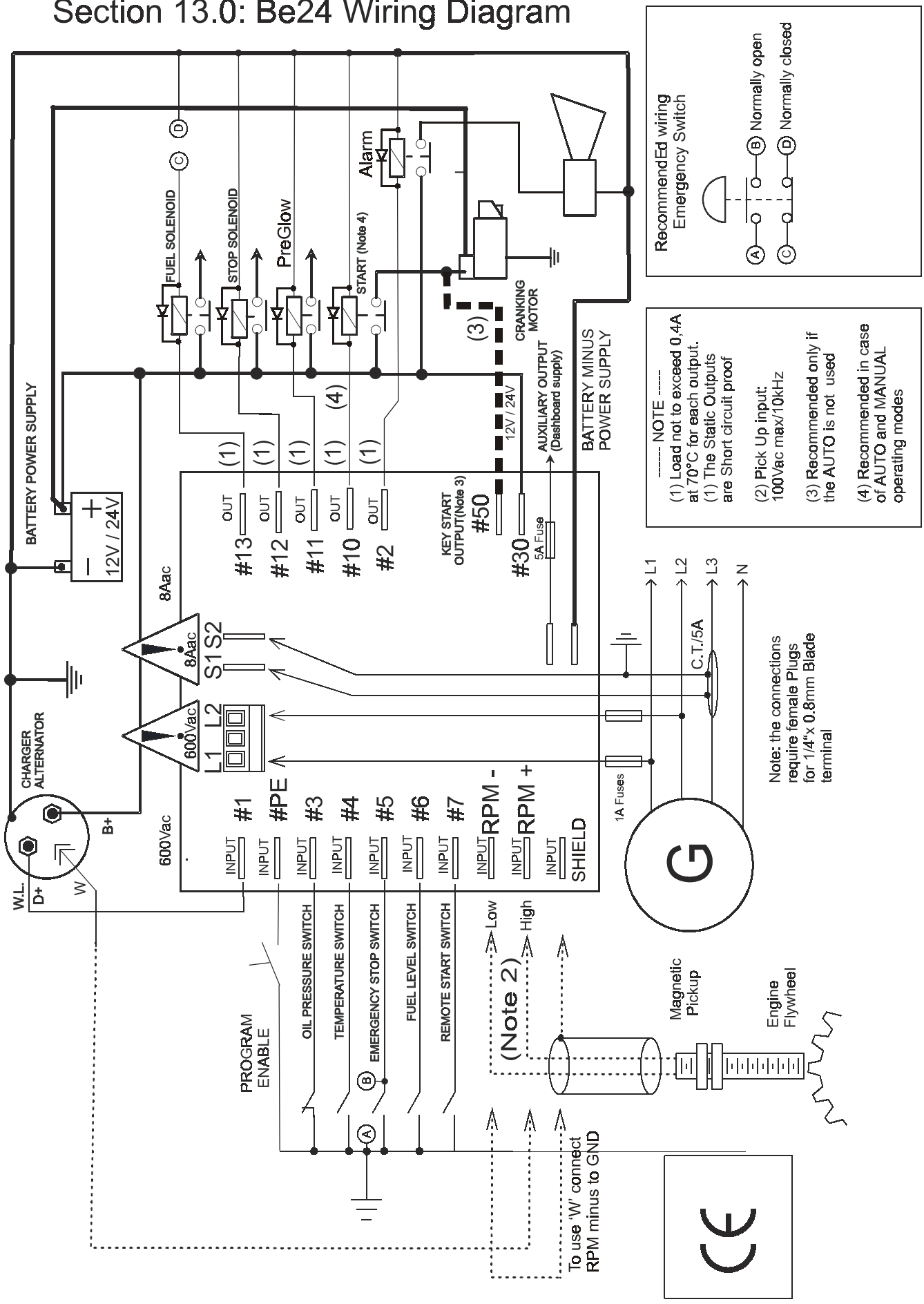
The BE24 uses the Generator voltage to protect against unwanted insertion of the starter motor. When the voltage is over 80Vac, the starter will be inhibited. The Generator presence does not affect the status of the green 'ENGINE RUNNING' LED. We do not recommend the insertion of switches (or breakers) in series, to the Vac of the BE24.

IMPORTANT: VERIFY THAT THE 'ENGINE RUNNING' LED ILLUMINATES WHEN THE ENGINE RUNS. THE USE OF THE ENGINE WITHOUT THIS INDICATION MAY BE DANGEROUS.

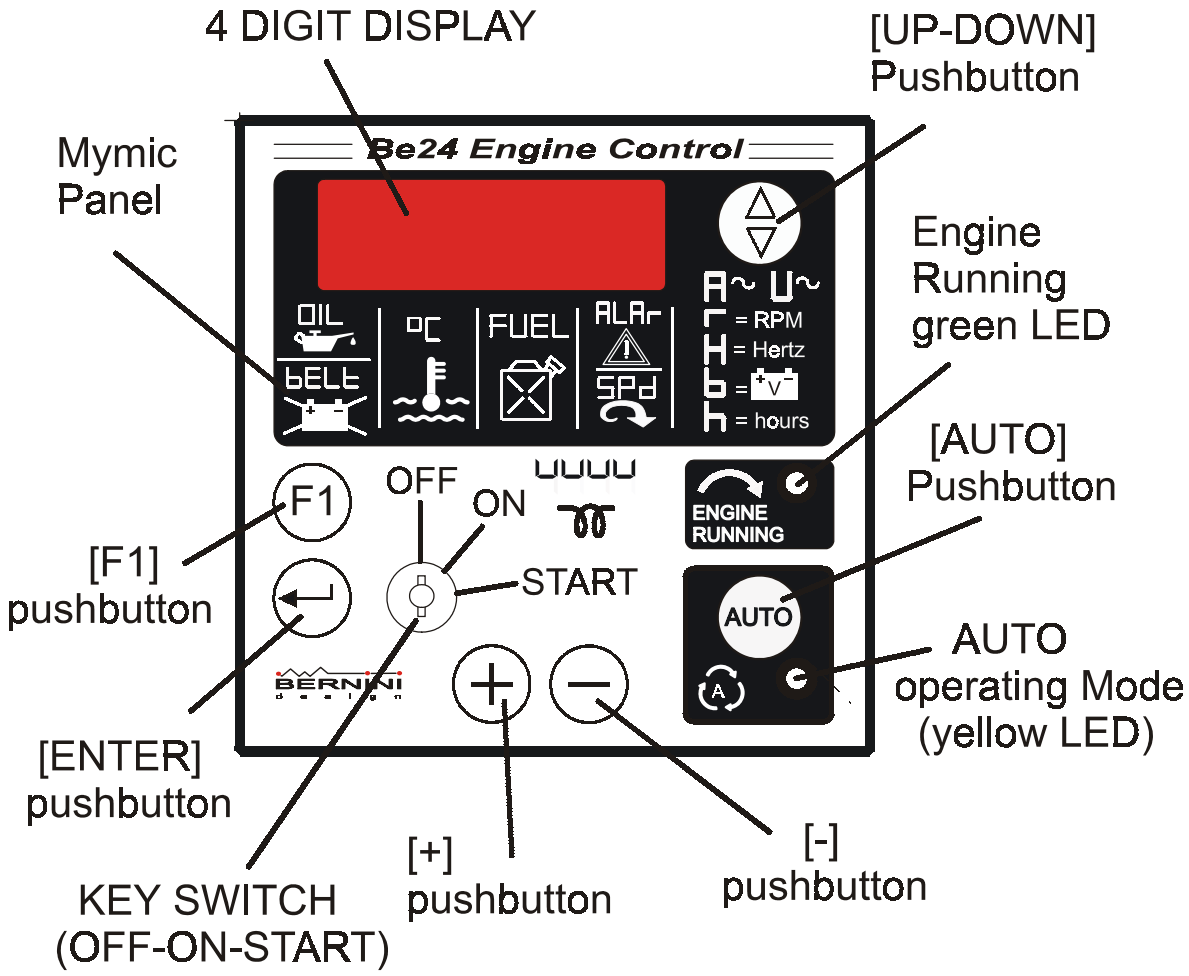
In case of a diesel engine, we recommend that you enable the BELT BREAK protection. This is accomplished by programming the code [on] in [P.15] (see section 11.0). To test the protection, it is necessary to disconnect the terminal D+ (W.L.) from the charger alternator, and connect to ground the #1 terminal (leaving the terminal D+/W.L. open on the Charger Alternator). The protection is delayed by about 15 seconds.

WARNING High voltage is present inside the Be24. To avoid electric-shock hazard, operating personnel must not remove the protective cover. Do not disconnect the grounding connection. Any interruption of the grounding connection can create an electric shock hazard. Before making external connections, always ground the PANEL first by connecting the control panel to ground.

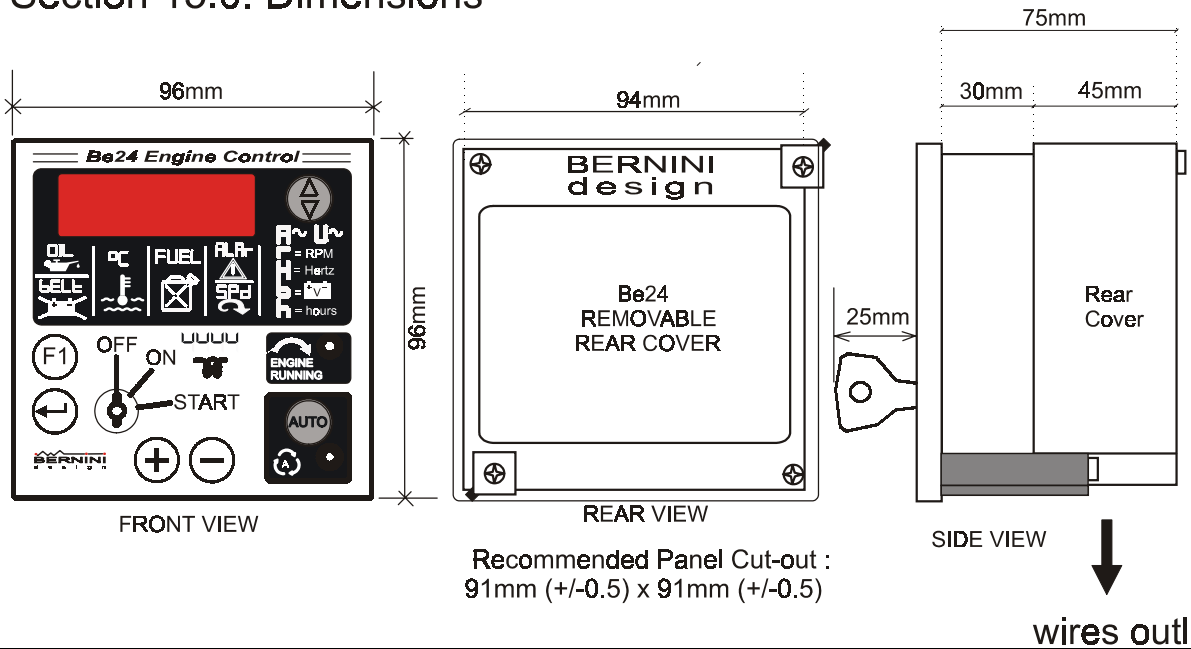
Section 13.0: Be24 Wiring Diagram



Section 14.0: Front Panel



Section 15.0: Dimensions



SECTION 16.0 CALIBRATION

To enter the Calibration use the following instructions:
1) - Turn OFF the KEY SWITCH. Connect to ground the PROGRAM terminal; verifying that the power supply is over 12.0V.
2) - Push and hold the [ENTER] pushbutton
3) - Turn ON the KEY and wait until the message [CAL] appears on the display (***NOTE 6***).
4) - Release the [ENTER] pushbutton: the message [L.1] indicates the first parameter. The BE24 is now ready for calibration. The adjustable measurements are indicated below:

DISPLAY	*MEASUREMENT / FUNCTION*	RECOMMENDED VALUES
[L.1]	**Generator Voltage (GAIN)**	200Vac up to 250Vac
[OFFS]	**Generator Current (OFFSET)**	GEN-SET not running (I=0)
[Curr]	**Generator Current (GAIN)**	80% of the C.T. size
[Ucc]	**Battery Voltage (GAIN)**	12V-14V or 24-28V
[Fr]	**Generator Frequency**	49Hz-51Hz or 58Hz-62Hz
[rPM]	**Engine Speed**	around nominal speed
[MEM]	**Memory Clear Procedure**	

NOTE 6: if the display shows the message [Err], follow the instructions described in section 16.1.

5)- It is possible to manually START the engine in order to provide electrical parameters for the BE24. ***In CALIBRATION MODE the alarms are not monitored.***
6) - Push the [UP-DOWN] pushbutton to select the measurement.
7) - Push [F1] and [+] (or [-]) pushbuttons simultaneously to update the measurement. The reading increases (decreases) by a small step each time the pushbutton is pressed. Better accuracy is obtained by using the value indicated in table 1 (recommended values).

TO SAVE follow the instructions:
- Push and hold the [ENTER] pushbutton
- Turn OFF the KEY-SWITCH in order to stop the engine.
- Wait for the [CAL][SAVE] and [Good] messages, and then release the [ENTER] pushbutton

TO EXIT without saving use the following instructions:
-turn OFF the KEY switch. After the STOP cycle, the BE24 enters the OFF operating mode.

16.1-To clear the memory *(to use in case of memory error)*:

- Enter the CALIBRATION (see 16.0).
- Push the [UP-DOWN] pushbutton to select the **[MEM]** message.
- Push the [F1] pushbutton until the message [Init] appears: the BE24 downloads the default settings (see section 11.0), clears the hour-count and removes calibrations.
- Turn off the KEY-SWITCH and remove the supply. Apply the supply; If the memory error persists, the BE24 must be returned for repair. If the BE24 works properly, program the parameters according to the characteristics of the genset.

SECTION 17.0 GENERAL SPECIFICATION

Supply Voltage (Batteries of the GEN-SET): 7Vdc to 33Vdc. **Reverse polarity**: permitted for unlimited time.
Supply Ripple: 15% up to 65 Hz, **Over Voltage**: 50V (60 secs) at 40 deg. C
V Battery Display error: 3% [**]. **Protection:** internal 300mA /60Vthermal fuse on the supply line
Supply Current Consumption: 30 mA up to 100mA maximum
Supply to Reset the System: 6,0V for 5 seconds. **Data Retention:** Non-Volatile memory
Dimensions: 96mm X 96mm X 75mm (includes connectors and rear cover)
Panel Cut-out: 91mm X 91mm, indoor operation
Operating Temperature range: -30 deg C to +65 deg C. **Humidity Range:** 5% up to 95% non-condensing
Weight: 450 gr., **Vibration:** 40mm/sec
General Design: 89/336 EEC, 89/392 EEC, 73/23 EEC, 93/68 EEC, IEC 68-2-6
Certification: CE

Static Outputs Characteristics (Engine Control)
Surge Output Current: 12A/30Vdc, an internal thermal PTC limits the output to 400mA **[*]**
Output Voltage: Battery Voltage

Generator Voltage Input Characteristics
Nominal Voltage input: 550Vac**.** Maximum allowed Voltage: 600Vac continuously
Over voltage: 2KVac phase to neutral. Insulation to ground: 2KVac / 300 seconds
Maximum Display error: +/- 3% **[**]**. Input impedance: 4 Mega Ohm

Current Transformer Characteristics
Current Transformer Size: 10/5Aac up to 1000/5Aac. Maximum Current: 8Aac for 10 seconds.
Maximum Display error: +/- 5% **[**]**. Internal resistance: 0.05 Ohm

Digital Input Characteristics
Open circuit voltage: 10Vdc (12V supply) or 22Vdc (24V supply)
Closed circuit current: 15mAdc maximum. Over voltage: 100V/10mS

Charger Alternator Monitoring
Operating Voltage up to 33Vdc. Over voltage: 100V / 20mS
Vdc reading accuracy +/- 5% (the calibration of this parameter is not available)
Threshold: 3Vdc-24Vdc (programmable). Excitation Power: max 3W

Pick-Up/'W'/'R' Characteristics
Input voltage range: 0,7Vac up to 50Vac/Vdc. Frequency range: 0Hz up to 10kHz
Input impedance: 2200 OHM

[*]*NOTE: THE TOTAL CURRENT OUTPUT OF #2#10#11#12 and #13 MAY NOT EXCEED 2A at 70°C*
[**]*NOTE: ERRORS CAN BE REDUCED BY MEANS OF CALIBRATION (SECTION 16.0)*

17.10 RPM SENSING

In order to determine the engine speed, the BE24 detects the R.P.M by using one of the following:
-Flywheel Pickup (Magnetic Pick-up)
-Alternator Pickup ('W' or 'R' terminal)
In order to adapt the speed sensor, the programmable parameter [P.23] is provided (see section 11.0). To calibrate the speed measurement, see section 16.00. For the wiring, follow the instructions of section 13.0

18.0 SOFTWARE UPGRADES

-V1.183 First issue
-V1.245 August 2004. The R.P.M. accuracy has been improved
-V1.252 January 2005. The current measurement accuracy has been improved

19.0 APPLICATION NOTES

19.1 Automatic Periodic Test

The BE24 does not use a clock to count the programmed days ([P.26] setting, section 11.0). The maximum error and drift of the counter is +/-0,5%. The user may experiment with shifting the periodic tests. To avoid error accumulation, we recommend the following procedures.

19.1A) First time programming of the Automatic Periodic Testing (A.P.T.)

---------- example: 7 days/20 minutes ----------

- enter the 'Program Mode' and set the [P.26] to 7 (section 6.0)
- set the [P.27] to 20
- save the programming
- select the AUTO operating mode

The BE24 will energize the GEN-SET after 7 days (or other desired value). The engine will run for 20 minutes.

19.1B) To adjust the starting moment:

- disconnect the power supply of the BE24
- wait for the desired start time (external clock reference)
- apply the power supply to the BE24
- select the 'AUTO' operating mode

The BE24 will start the engine after 7 days (or other desired value). The engine will run for 20 minutes.

IMPORTANT NOTES

If the supply (battery voltage) is removed, the BE24 loses the counts and timings. If the supply restores, the BE24 starts to count the A.P.T. according to the programmed parameters [P.26] and [P.27]. It is important to synchronize the power on sequence with the desired A.P.T (see 19.1B).

19.2 OUTPUT START RECOMMENDATION

If the application requires only the MANUAL operating mode, the easiest solution is to directly use the KEY switch output (output ‘50’). In case of the use of AUTO operating mode, the static output #10 is provided for MANUAL and AUTO start (do not use the output ‘50’).

CAUTION : using output #10 and output #50 together will damage the starting motor.

19.3 GENERATOR CONTACTOR CONTROL

The BE24 can drive an external CONTACTOR. The output is shared with the ALARM output. In order to use the CONTACTOR output, the setting of the parameters [P17] must be [inh.]. In this way, the ALARM OUTPUT mode is inhibited, and the CONTACTOR mode is enabled. The CONTACTOR output will energize in AUTO operating mode when the VOLTAGE, FREQUENCY and SPEED are within the settings. The contactor will de-energize in case of ALARM, or when the AUTO mode is removed. In AUTO operating mode, the contactor de-energizes according to the REMOTE CONTROL input. The engine will shut down after a programmable cooling down timing.

Section 20.0: Description of the connections

Reference designator	Connection Type	Function Type	Description of the connection
#1	Blade ¼’	In./Out	Charger Excitement/D+ input
#2	Blade ¼’	Output	Alarm / Contactor Static Output 400mA
#3	Blade ¼’	Input	Oil Pressure switch
#4	Blade ¼’	Input	High Temperature
#5	Blade ¼’	Input	Emergency Alarm switch
#6	Blade ¼’	Input	Fuel Level switch
#7	Blade ¼’	Input	Remote Start switch
OUT	Blade ¼’	Output	Dashboard Supply 5Adc rating
-V	Blade ¼’	Input	BE24 supply (BATTERY MINUS)
#10	Blade ¼’	Output	START (Automatic) Static Output 400Ma
#11	Blade ¼’	Output	Pre-GLOW Static Output 400mA
#12	Blade ¼’	Output	STOP SOLENOID Static Output 400mA
#13	Blade ¼’	Output	FUEL SOLENOID Static Output 400mA
Program	Blade ¼’	Input	PROGRAM ENABLE TERMINAL
RPM-	Blade ¼’	Input	Magnetic Pick-Up or ‘W’ (ground reference)
RPM+	Blade ¼’	Input	Magnetic Pick-Up or ‘W’
GND	Blade ¼’	Output	Pick Up shield or reference ground
L1	Connector (Male-Female)	Input	GENERATOR Vac (max 600Vac)
L2	Connector (Male-Female)	Input	GENERATOR Vac (max 600Vac)
S1	Connector	Input	CURRENT TRANSFORMER /5Aac
S2	Connector	Input	CURRENT TRANSFORMER /5Aac
#30	Blade ¼’	Input	Key-Switch and Be24 Vdc Battery Supply (50Adc)
#50	Blade ¼’	Output	Key-Switch CRANK PILOT OUTPUT (30Adc)

21.0 Panel/Gen-set Builders Notes